of doctors, however, 68% believe that the disease is only transmitted via a vector (Lugo-Caballero et al., 2017). As mentioned, Chagas disease has multiple modes of transmission and is not exclusive to vector-borne transmission, displaying physicians' lack of education on how the disease can spread. Seventy-eight point six percent of physicians stated that they would suspect Chagas if a patient presented symptoms such as an edematous lesion on the eyelids, but only 40% of the participating doctors in this study indicated the proper diagnostic method, which is either a PCR or an immunosorbent assay (Lugo-Caballero et al., 2017). Physicians cannot even identify proper diagnostic methods, making it extremely difficult for them to administer proper treatment since they are unable to properly determine if people even have Chagas disease.

Not only are physicians undereducated about the disease, but the public is undereducated as well. In one study, individuals from various rural and urban regions in Bolivia were asked about their perception and knowledge of the triatomine bug. Indigenous populations such as Ayoreo and Guarani were more aware of the triatomine bugs than individuals who lived in an urban setting (Salm & Gertsch, 2019). Unexpectedly, however, the indigenous populations were less educated on the bugs than the urban populations were. Specifically, in Ayoreo, only about 24% knew about Chagas disease, 4% did not consider the disease dangerous, and 12% simply considered the bugs a nuisance (Salm & Gertsch, 2019). Although people in Ayoreo were able to identify the bugs, few of them were able to associate them with the life-threatening disease and were unafraid of the bugs themselves. The other rural populations stated that they had heard of a disease associated with the bug but were unable to name the disease that it caused (Salm & Gertsch, 2019). Their lack of education on Chagas disease and how it is transmitted to humans via the triatomine bug feces creates a lack of threat perception since they are not educated on the danger of the disease. The gap in education on Chagas disease in both the public and physicians makes it extremely difficult for measures to be taken for both prevention and treatment of the disease and inevitably causes avoidable complications and deaths.

**Cultural impact on Chagas disease**

Minimal education on Chagas disease is not the only contributor to its prevalence in Latin America, but cultural aspects in various countries have impacted its prevalence as well. Foods, such as various fruits consumed in Brazilian and Venezuelan culture, are often contaminated with triatomine feces, making them vehicles for the oral transmission of Chagas disease, which is slowly becoming the most frequent mode of transmission (Nascimento et al., 2021). A major suspect in the transmission of Trypanosoma cruzi is the açai berry, which is commonly consumed as a beverage in Latin America (Santana et al., 2019). In Brazil, between 2007 and 2016, there were 1,579 confirmed cases of acute Chagas disease in Pará (Nascimento et al., 2021). Nascimento et al. analyzed the prevalence of the disease in the Tocantins health region of Para, where they had the highest concentration of confirmed disease cases. In the Tocantins health region, there is an abundance of açai production and consumption, due to the fruit being a large part of their culture and their economy (Nascimento et al., 2021). Açai production is a major source of their income and is also a large part of their diet, often considered by the locals as their main meal (Nascimento et al., 2021). They found that many of the acute cases of Chagas were confirmed between the months of July and December, which correlated with the harvest time of açai (Nascimento et al., 2021). To confirm if these cases were spread through the consumption of açai, they determined the modes of infection and discovered that 73.59% of the cases were transmitted orally (Nascimento et al., 2021). Santana et al. also conducted a study in Brazil where they confirmed that individuals who had consumed açai from the same source tested positive for Trypanosoma cruzi. Similarly, in Venezuela, there was an outbreak of orally transmitted Chagas in 2009, and the culprits were the artisanal juices that were being prepared and served at the local school in Chichirivivhe de la Costa (Alarcón de Noya et al., 2016). Information on whether infected and uninfected individuals consumed artisanal juices from various fruits

rate of infection and infestation is due to their housing conditions, which consist of mud walls and cardboard walls and roofs, making them more vulnerable to triatomine bugs (Fernández et al., 2019). Their low levels of vector control through their lack of insecticide use are also a huge contributor to the high rates of home infestations (Fernández et al., 2019). Creoles, who had a lower social vulnerability index, were twice as likely to use insecticides, proving that vector control methods are less likely to be maintained in more socially vulnerable populations (Fernández et al., 2019). Overall,populations of higher social vulnerability index are subject to higher infection and infestation rates, revealing that inequalities in healthcare are based on different social and economic statuses. This is key to assessing what populations in Latin America need to be targeted for vector control, case detection, and treatment of Chagas (Fernández et al., 2019). It will also aid in lowering the rates of infection, spread, and health inequalities among different social and economic statuses.

**Chagas disease economic impact**

Chagas disease also heavily impacts the economy in Latin America. It has caused a loss of 752,000 days (about 2,059 years) of work and has an average annual cost of $1.2 billion in the southern regions of Latin America (Miranda-Arboleda et al., 2021). It is estimated that an infected person from low to middle-income countries in Latin America faces upwards of $636 in annual health expenses (Olivera & Buitrago, 2019). Specifcally in Colombia, around 788,742 adults are predicted to have Chagas disease, which makes up 1.6% of their population (Olivera & Buitrago, 2019). However, only 1.2% of the predicted cases know that they have the disease (Olivera & Buitrago, 2019). From just that small percentage of individuals, it accumulated a total direct medical cost of US $5.7 million, which is 53.2% of the total medical costs in Colombia in 2017 (Olivera & Buitrago, 2019). This economic burden is due to the cardiac complications associated with Chagas that require expensive diagnostic tests, specialized medical consultations, and implantation procedures (Olivera & Buitrago, 2019). Had all the individuals been diagnosed with Chagas disease, the direct medical expenses would have surpassed US $140 million, which would have placed Colombia in a much more detrimental economic state (Olivera & Buitrago, 2019). The indirect medical costs attributed to Chagas disease was US $5.8 million and its main contributor was presenteeism (Olivera & Buitrago, 2019). Presenteeism is known as decreased work performance due to illness, and it accounted for more than 50% of the indirect costs of Chagas (Olivera & Buitrago, 2019).

Premature mortality because of Chagas disease has also heavily impacted the economy due to lost productivity in Colombia. In 2017 it contributed US $515,228 to the total indirect costs, which is minuscule in comparison to the cost of presenteeism (Olivera & Buitrago, 2019). However, it has heavily contributed to the cost of lost productivity (Olivera & Buitrago, 2019). From 2010 to 2017, there were 1,261 deaths from Chagas disease at the working age, which added up to a total of 48,621 potential years of work lost (Olivera et al., 2021). The total cost of lost productivity from premature mortality was US $29,683,913 (Olivera et al.,

have thousands of dollars because fewer infants will have to go through different forms of costly testing and treatment (Bartsch et al., 2020). Depending on the various efficacy levels of the vaccine, it can save US $42,487 to US $131,452, from a third-party payer perspective and US $403,083 to US $1.22 million from a societal standpoint (Bartsch et al., 2020). The development of a vaccine for Chagas disease is a promising solution to terminate the spread of Chagas disease through congenital transmission because of its ability to prevent the suffering of both mother and child whilst saving thousands of dollars from both a societal and economic standpoint.

**Chagas disease interventions**

Ribeiro, V. V., Dias, N., Paiva, T., Hagström-Bex, L., Nitz, N., Pratesi, R., & Hecht, M. (2020). Current trends in the pharmacological management of Chagas disease. I*nternational Journal for Parasitology-Drugs and Drug Resistance*, 12, 7–17. https://doi.org/10.1016/j.ijpddr.2019.11.004
Salm, A., & Gertsch, J. (2019). Cultural perception of triatomine bugs and